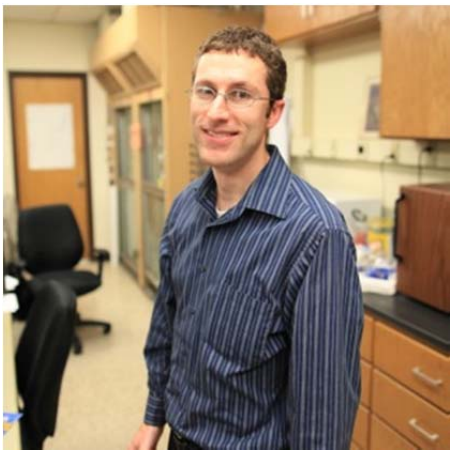
Improved Grid Management through Predictive Residential Air Conditioning Control



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As of 2011, there were over 132 million housing units in the United States, and of those 87% had air conditioning units. In the southern United States, the percentage of homes with air conditioning approaches 100%. These air conditioning units exacerbate peak electricity demand issues, straining the grid. For example, during the summer peak in 2011 in the Electric Reliability Council of Texas (ERCOT) grid, over 50% of the total electrical load was from residential homes, primarily driven by their air conditioning systems. Because of the wide range in power demand due to air conditioners, the residential sector will be an important contributor in future grid management.

This talk discusses the potential of coordinated air conditioning control for a simulated community of 900 homes. The simulated community of homes is created from an extensive data set including home energy audits, homeowner surveys, and electricity meter measurements from actual homes in Austin, Texas, USA. Coordinated air conditioning in the homes is simulated using dynamic optimization to reduce the peak demand or the electricity costs of the community using both centralized and decentralized methods. By manipulating thermostat set points, the optimization scheme takes advantage of the thermal mass of the buildings to store thermal energy. This stored thermal energy can then be used increase the flexibility of the community in responding to grid needs.

Wesley Cole is a chemical engineering Ph.D. candidate at the University of Texas at Austin working with Dr. Tom Edgar. He earned his B.S. in chemical engineering from Brigham Young University. His research interests include combined heat and power systems, heating ventilation, and air conditioning (HVAC) systems, thermal energy storage, and the integration of these systems into the smart grid. His work seeks to improve energy systems in order to improve overall sustainability. Wesley has worked as a research assistant in the wildland fire research laboratory at BYU, the biomass and bioenergy sector of the Idaho National Laboratory, and the commercial buildings research group at the National Renewable Energy Laboratory. He and his wife, Cassie, are from Kuna, Idaho, and are the parents of three boys.